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# The Hintons in your Neural Network

## A Quantum Field Theory View of Deep Learning

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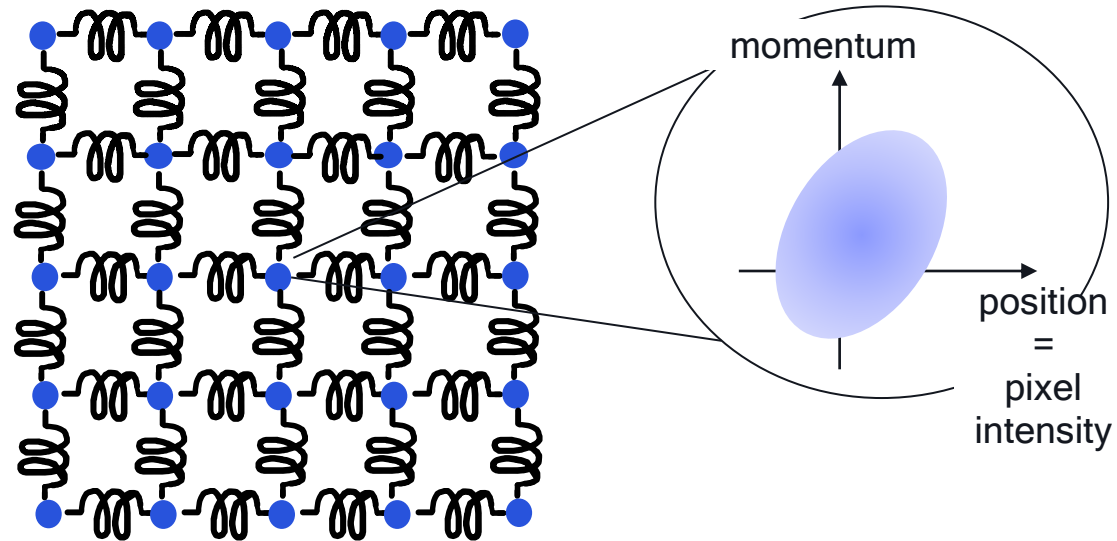
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# Background

- Quantum computers perform computations intractable for classical computers.
- Will quantum computers spur the next revolution in AI?
- In this work we construct quantum neural networks using quantum field theory



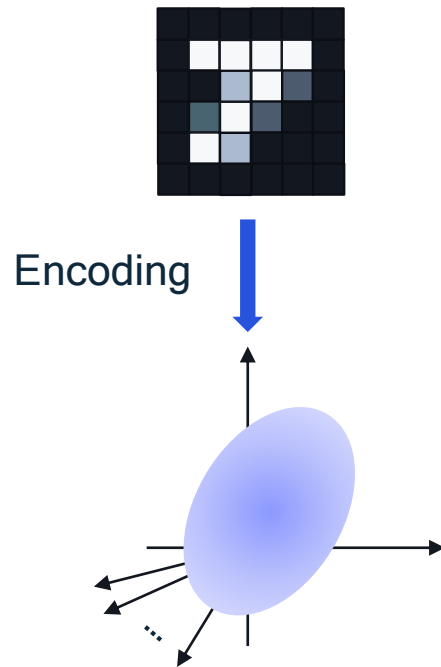
Classical Field



Quantum Field

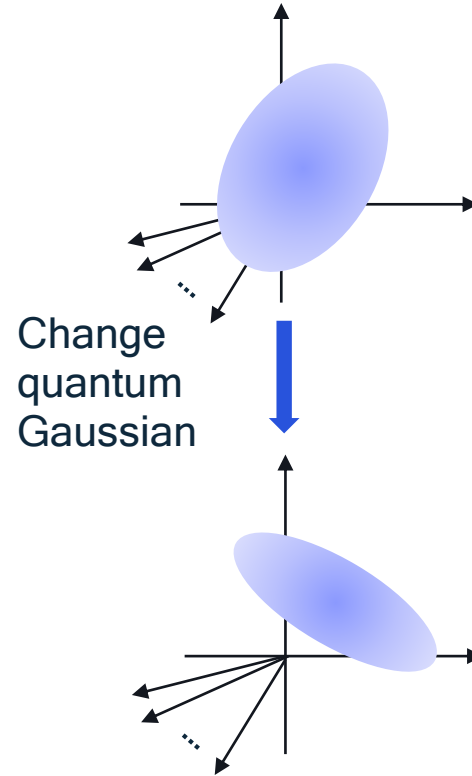
# Quantum Neural Network

- Quantum Gaussian Process



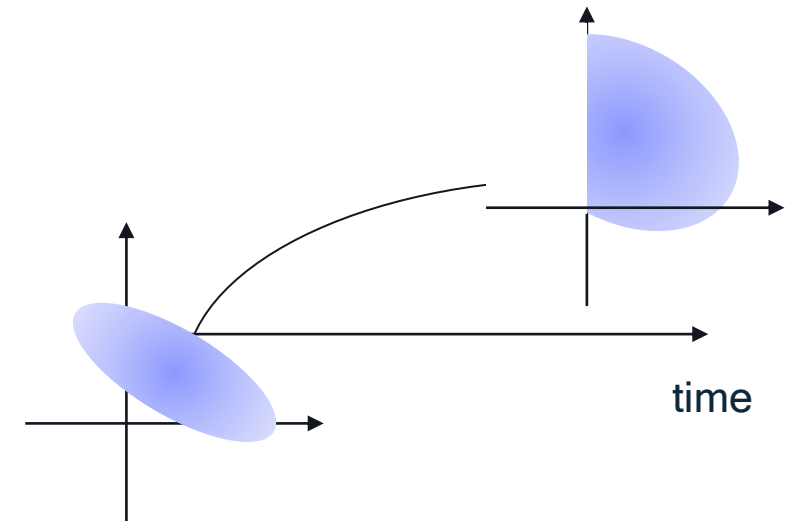
- Interpolate missing data, quantum version of [Finzi et al, ICLR2021]

- Quantum Linear Layer



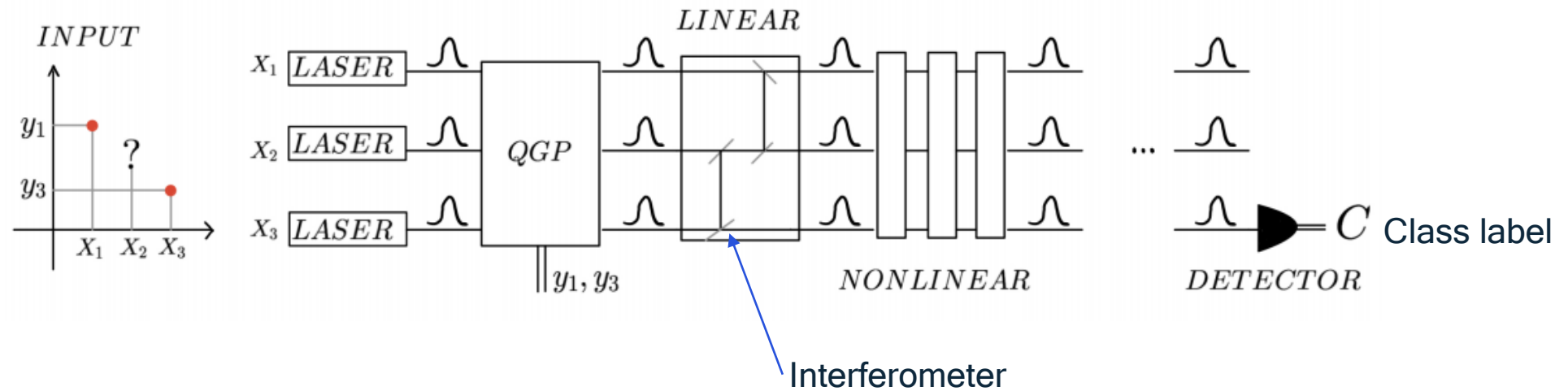
- Cf [Killoran et al, Phys Rev. 2019]

- Quantum Non-Linearity

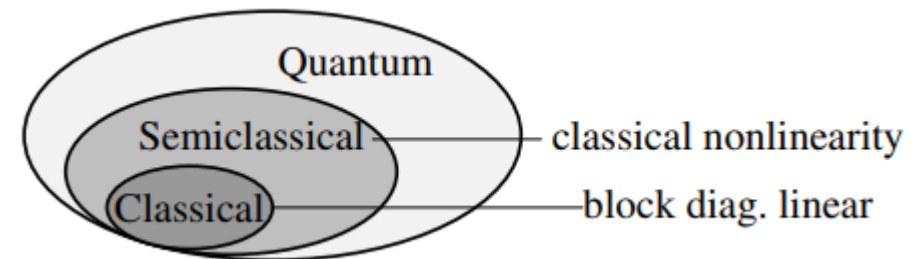


- Unitary time evolution that reduces to ReLU when no entanglement
- More efficient than previous proposals

# Quantum Optical Implementation



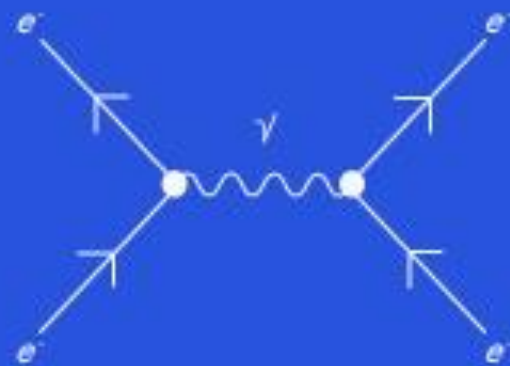
- Our model runs efficiently on an optical quantum computer
- Classical neural networks as particular case
- We study a semiclassical approximation



We've discovered





# The Hinton Particle

Particle physics for machine learning





# Thank you

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